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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/510,389	12/14/2004	Nobuo Ishii	101248.55500US	6492

23911 7590 09/02/2008

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EXAMINER	
DHINGRA, RAKESH KUMAR	
ART UNIT	PAPER NUMBER
1792	
MAIL DATE	DELIVERY MODE
09/02/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/510,389	ISHII, NOBUO	
	Examiner	Art Unit	
	RAKESH K. DHINGRA	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *03* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 June 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *07 October 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *05/08*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 1-4 have been considered but are moot in view of the new ground(s) of rejection as explained hereunder.

Applicant has amended claim 1 by adding new limitations "first" and "thereby strengthening mutual coupling between the first and second standing wave formed in the radial waveguide".

New reference (US 3,88,624 – Kazumi et al) when combined with Ishii et al and Kazumi et al ('768) reads on amended claim 1 limitations. Accordingly claims 1-4 have been rejected under 35 USC 103 (a) as explained below. With regard to applicant's argument that in Kazumi ('768) a standing wave is formed inside a ring 13 and hence a standing wave moves within a region inside the ring, and that this reference does not teach a node of a standing wave outside the conductive ring, examiner responds that Kazumi ('624) teaches that by controlling ratio of diameter of the antenna and the emitting port 14, the electric field distribution in the radial direction can be controlled. Further, Kazumi ('768) teaches that by controlling the gap between the dielectric window 14 and the antenna 11, position of node of standing wave (second standing wave) of the electric field distribution can be controlled. It would thus be obvious to control the diameters of the antenna and the radial waveguide, and the gap between antenna and the dielectric window (as result effective variables) as taught by Kazumi et al ('768) in the apparatus of Ishii et al in view of Kazumi et al ('624) to control the position of the nodes of the first and second standing waves standing to control the electric field distribution and the plasma

distribution in the processing chamber. Thus, claims 1-4 have been rejected under 35 USC 103 (a) as explained below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishii et al (US PGPUB No. 2002/0038692) in view of Kazumi et al (US 6,388,624), and Kazumi et al (US 6,793,768).

Regarding Claim 1: Ishii et al teach a plasma processing apparatus (Figures 1, 9, 14, 20) for effecting predetermined processing on a substrate by exposing the substrate to a plasma production region, comprising:

a chamber 11 in which the substrate 21 is introduced;

a top plate portion (dielectric plate 13) arranged above said substrate 21 introduced in said chamber, and forming a part of a wall of said chamber 11; and

an antenna portion 30 supplying a high-frequency electromagnetic field into said chamber to form the plasma production region in a region between said top plate portion 13 and said substrate 21 located in said chamber 11, wherein said antenna portion 30 includes a radial waveguide 36 having a predetermined inner diameter, said chamber 11 has a predetermined inner diameter in a portion containing said top plate portion 12 and said antenna portion 30 (paragraphs 0048-0058). Ishii et al also teach that by using formula 27 (paragraph 0144) it is possible to compute composite dielectric constant of the space portion containing the window and the slot antenna, if other variables like dielectric constant of top plate (window), dielectric constant of the space between window and antenna (air in this case), thickness of dielectric window and the gap between the window and the slot antenna are known (Fig. 14 and para. 0144 - 0146). Based on this composite dielectric constant, value of wavelength lambda.sub.g (given in the claim) can be calculated (by using formula lambda /dielectric constant).

Ishii et al teach inner diameter of the radial waveguide (Fig. 9A), but do not teach relative dimensions of the inner diameter of radial waveguide and the portion containing top plate portion and the antenna portion and their relationship, and also do not teach a portion of the plasma processing apparatus containing the top plate portion and the antenna portion is configured such that a node of a first standing wave formed at the top plate portion and in a space between the top plate portion and the antenna portion is present at a position corresponding to an outer peripheral end of the radial waveguide, thereby strengthening mutual coupling between the first standing wave and a second standing wave formed in the radial waveguide {claim limitations “a first standing wave formed at the top plate portion and in a space between the top plate portion and

the antenna portion" and "a second standing wave formed in the radial waveguide" are contradictory to the applicant's disclosure (e.g. at page 5, lines 4-12) that describes "a first standing wave formed in the radial waveguide" and a second standing wave formed in the portion containing the top plate portion and the antenna portion". Therefore, for the purpose of examination, these limitations have been interpreted as per applicant's specification that is, "a first standing wave formed in the radial waveguide" and a second standing wave formed in the portion containing the top plate portion and the antenna portion". Applicant is invited to clarify/amend the claim}.

Kazumi et al ('624) teach a plasma apparatus comprising:

A vacuum vessel 1 with a processing chamber 3a, an antenna 17, a dielectric emitting port 14 (having diameter similar to dimension B in the claim) similar to through which high frequency is supplied to the processing chamber. Kazumi et al ('624) further teach that the supplied UHF wave propagates in the form of a standing wave that is determined by the antenna diameter and the emitting port diameter, and by controlling these two variables, the electric field intensity can be changed in the radial direction {e.g. Figs. 1, 8A, 8B and col. 4, line 15 to col. 5, line 53). It would be obvious to control the position of a node of the first standing wave in the apparatus of Ishii et al for the purpose of controlling the electric field distribution in the radial direction by controlling the antenna diameter and the diameter of the emitting port aperture (that is dimensions "A" and "B" of the claim).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to optimize the antenna diameter (A) and the diameter of the chamber portion containing the top plate and the antenna (B) as taught by Kazumi et al ('624) in the apparatus of

Ishii et al to control the electric field distribution in the radial direction near the antenna region and thus control electromagnetic field in the plasma generation due to standing waves.

Ishii et al in view of Kazumi et al ('624) do not explicitly teach a portion of the plasma processing apparatus containing the top plate portion and the antenna portion is configured such that a node of a first standing wave formed in the radial waveguide {as already taught by Kazumi et al ('624)}, enables strengthening mutual coupling between the first standing wave and a second standing wave formed in the portion containing top plate portion and in a space between the top plate portion and the antenna portion.

Kazumi et al ('768) teach a microwave plasma apparatus comprising:

A processing chamber 2 with lower electrode 5 for supporting a substrate, with a disk shaped antenna 11 having a radius 10R, and a shield 10 having an inside radius 10R (radius of waveguide). Kazumi et al ('768) further teach that by selectively determining (optimizing) the radius of the antenna 11, and the diameter of the waveguide 10 and the dielectric material filling the space between the antenna and the waveguide, the electric field strength distribution around the antenna 11 can be controlled. Kazumi et al ('768) further teach that by controlling the gap between the dielectric window 14 and the antenna 11, position of node of standing wave (second standing wave) of the electric field distribution can be shifted towards periphery of the plasma. Kazumi et al ('768) also teach that diameter of the processing chamber can also be used instead of the effective diameter of the waveguide to control the ratio between the central and peripheral electric field strengths (e.g. Figs. 1, 3, 7, 9-11 and col. 5, line 38 to col. 6, line 14 and col. 11, lines 1-32 and col. 13, line 52 to col. 14, line 50). Though Kazumi et al ('768) do not explicitly teach the claimed relationship B-A/2 =lambda.g/2*N, he does teach controlling the relative

diameters of the antenna and the waveguide, as well as the gap between the antenna and the dielectric window, to control position of the node of the standing
wave of the electric field distribution at the periphery of the antenna. It would be obvious to control the diameters of the antenna and the radial waveguide, and the gap between antenna and the dielectric window (as result effective variables) as taught by Kazumi et al ('768) in the apparatus of Ishii et al in view of Kazumi et al ('624) to control the position of the nodes of the first and second standing waves standing to control the electric field distribution and the plasma distribution in the processing chamber. Further, claim limitation, to strengthen mutual coupling between first and second standing waves, is a functional limitation and since the apparatus of prior art meets the structural limitations of the claim, the same is considered capable of meeting the functional limitation.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to optimize the diameters of the antenna and the radial waveguide (as result effective variables) as taught by Kazumi et al ('768) in the apparatus of Ishii et al in view of Kazumi et al ('624) to control the position of the nodes of the first and second standing waves thus enabling control electric field distribution and the plasma distribution in the processing chamber.

In this connection courts have ruled:

1) Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danly*, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). Apparatus claims cover what a device is, not what a device does *Hewlett-Packard Co. V. Bausch & Lomb Inc.,* 15USPQ2d 1525, 1528 (Fed. Cir. 1990)

2) It would have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable through routine experimentation in the absence of a showing of criticality. *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Regarding Claim 2: Kazumi et al ('768) teach that antenna diameter 'a' and diameter of the waveguide 'c' are optimized so that ratio of antenna diameter 'a' to the effective diameter 'c' of the waveguide can be 0.6 or above (that is, the ration can be 0.6 or higher). Further, Kazumi et al also ('768) teach that chamber diameter may be used instead of the effective diameter the waveguide. Thus chamber diameter 'C' can be equal to the antenna diameter 'A' (Figs. 3, 7 and col. 13, line 52 to col. 14, line 50).

Regarding Claims 3, 4: Kazumi et al ('768) teach that top plate 14 is made from quartz (dielectric material) [col. 9, lines 10-25].

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH K. DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Rakesh K Dhingra/
Examiner, Art Unit 1792

/K. M./
Primary Examiner, Art Unit 1792